RESEARCH HIGHLIGHTS

1995 - 1996

U.S. SUGARCANE FIELD LABORATORY

Sugarcane Research Unit

Southern Regional Research Center

Agricultural Research Service

United States Department of Agriculture

Houma, Louisiana

MISSION AND STAFF

The mission of the Sugarcane Research Unit is to conduct basic and applied research to increase sugarcane production efficiency while minimizing the impact of the crop's culture on water quality and other ecosystems to include wet land preservation in the high rainfall, mineral soil, subtropical climate of the lower Mississippi Delta. Further, this research will have general applicability to the research programs of the other sugarcane producing states. The Unit will approach this mission by developing improved sugarcane germplasm and cultivars through conventional breeding and molecular approaches that combine traits to overcome productivity barriers with genetic resistance to disease and insect pests, cold tolerance, and ratoon longevity. These new biotechnology tools will be applied to our specific climatic and edaphic condition facilitating production efficiency. An equally important aspect is to develop and integrate effective management strategies which complement the cultivars developed, hasten maturation and sugar storage, and combat a constantly evolving group of disease, insect, and weed pests - pests which often exhibit genetic diversity within their populations. Traditional tactics of integrated pest management such as biological control and host plant resistance involving natural predators/plant pathogens, high unit activity pesticides, and cultural practices developed through interdisciplinary research will be designed to reduce pesticide loading per unit area and keep pest populations below Unit-identified economic damage threshold levels.

The productivity of the Research Unit is greatly enhanced by the support of the American Sugar Cane League and the cooperation of the Louisiana Agricultural Experiment Station. The research reported here is a progress report of recent research.* The current USDA-ARS professional staff and the authors of this report are as follows:

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* The data and interpretations in this report may be modified by additional experimentation; therefore, the report should not be published in part or whole without prior approval of the Sugarcane Research Unit, USDA-ARS, Houma, Louisiana and the cooperation agencies and organizations concerned.

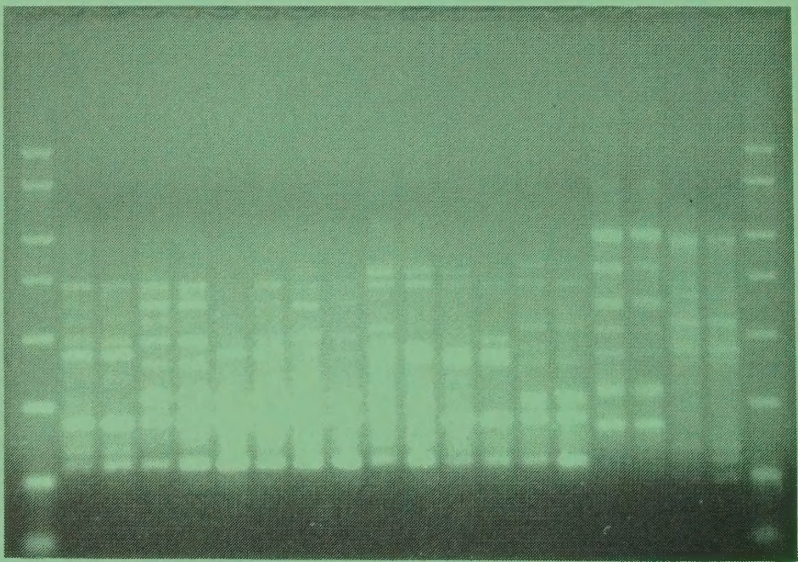
BREEDING

Basic Crosses. Sugarcane cultivars are interspecific and intergeneric hybrids derived from crosses of related species such as *Saccharum officinarum*, *S. spontaneum*, and *S. robustum*. The genetic base is rather limited because cultivars are derived from only a few clones of these species. A limited genetic base could predispose sugarcane cultivars to suboptimum yield and susceptibility to pests. The basic breeding program established at Houma in 1972 has the objective of broadening the genetic base of our cultivars. This is accomplished by intercrossing adapted Louisiana sugarcane with exotic germplasm. Traits contributed from exotic relatives include resistance to diseases (sugarcane mosaic virus, smut, leaf scald, and ratoon stunting disease), stalk borer, leaf and stalk cold tolerance, and increased yield through better ratooning ability and better adaptation to mechanical harvesting. The hybrid plants are field selected and crossed again with elite clones. Repeated crossing and field selection leads to the development of hybrid plants with enhanced genetic diversity. However, the breeding process is very time consuming. Final selection requires a minimum of 12 years from the date of the initial cross to identification of hybrid plants suitable for cultivar release.

Nearly 5,000 crosses yielding 7.7 million seeds were made from 1972 through 1996. About 200 crosses are made annually between 60 unique parents yielding 300,000 seeds. We continually strive to improve our crossing effectiveness and use new parental clones.

A living collection of native North American relatives of sugarcane was begun in 1992. We now have about 110 populations of eight species and varieties collected from the southeast USA. These native North American species may have disease resistance or adaptability traits that are absent from other sugarcane species. Crosses have been attempted between sugarcane and this germplasm since 1993, but molecular tests indicate that we have yet to obtain hybrid progeny. Further study is needed to obtain hybrids and determine their breeding value.

There were 145 candidate cultivars selected from basic crosses, four of which were released to the industry TUCCP 77-42 in 1989 (Argentina), LHo 83-153 in 1991, and HoCP 85-845 and LCP 85-384 in 1993. The last three cultivars were derived from the *S. spontaneum* clone US 56-15-8. Also, 408 hybrid clones were assigned US numbers from field selection, for crossing with cultivars. **(D.M. Burner and B.L. Legendre)**



DNA fingerprints of various sugarcane species

Summary of basic breeding program at Houma, LA.

Breeding year	Seedlings set to field	Established in 1st line trials	Established in 2nd line trials	Superior clones receiving permanent assignments US	Superior clones receiving permanent assignments CP[1]
1972-76	138,216	5,302	863	118	22
1977-81	105,429	7,452	1,027	133	45
1982-86	126,131	8,137	1,283	108	34
1987	21,116	1,527	106	12	2
1988	22,425	659	78	14	7
1989	21,065	1,876	193	17	29
1990	16,909	912	97	6	6
1991	14,201	577	113	--[2]	--
1992	18,445	893	150	--	--
1993	8,134	381	87	--	--
1994	12,035	893	---	--	--
1995	14,358	---	---	--	--
1996	12,000[3]	---	---	--	--
Total	530,464	28,609	3,997	408	145

[1] Includes Ho and HoCP assignments.
[2] Data not yet available.
[3] Estimated.

Tassels in crossing cubicles.

Seedling and Clonal Selection. Historically, all true seed for the commercial breeding and selection program at Houma and, prior to 1972, all seed for the basic breeding and selection program came from crosses made at Canal Point, FL. However, since 1972, the basic crossing program for Louisiana has been conducted at Houma.

The progression of a cross through the selection program from seed to assignment of permanent numbers is described by Breaux (1973) and Dunckelman and Legendre (1982) for the commercial and basic breeding programs, respectively. In the past, preliminary screening of seedlings for resistance to sugarcane mosaic virus was conducted in the greenhouse; however, since 1979 this practice has been replaced by careful parent selection in which at least one of the parents used in a cross is resistant to mosaic. Thereafter, selection for mosaic resistant clones begins in the first-ratoon crop of the single-stool nursery and continues throughout the 12-year selection process. Other selection criteria used in the single-stool nursery include stalk number, diameter, height and density, erectness, absence of pith or pipe (hole) and refractometer Brix. Further, some clones in single stools are rejected for extreme growth cracking along the stalk, germinated or protruding buds, excessive adventitious roots, extreme sensitivity to herbicides and extreme reaction to the sugarcane borer. Evaluation is continued in single-row, 1.8 m (6 ft) and 5.2 m (16 ft) clonal plots (first- and second-line trials, respectively. Essentially, the same selection criteria are used in both clonal plots as is used in the single-stool nurseries with the exception that stalk weight and laboratory Brix and sucrose content are determined from a 10-stalk sample on all agronomically acceptable clones. For the second-line trials, estimated yield of theoretical recoverable sugar per ton of cane and per acre are calculated from mean stalk weight, population and laboratory data for Brix and sucrose.

Clones with commercial potential in the first-ratoon crop of the second-line trials are assigned permanent HoCP or Ho (Houma/Canal Point or Ho) numbers and replanted in replicated nurseries for further evaluation. Currently, the Ho designation is being used for commercial assignments made from the basic breeding program at Houma while the HoCP designation is for commercial assignments where the seed are produced at Canal Point from Louisiana parents and selected at Houma. Early generation hybrids from new basic breeding lines not assigned Ho numbers are assigned US (Untied States) breeding numbers and used in the basic breeding program as nonrecurrent parents for another cycle of backcrossing with selected commercial clones or varieties used as recurrent parents.

Significant gains (approximately 44%) in sucrose content have been made at Houma through 5 cycles of recurrent selection since the inception of the breeding and selection program in Louisiana. Concurrently, sugar recoveries at the State's mills have increased dramatically and now exceed 10% per gross ton of cane for a 7 to 9 month growing season. The sugarcane breeding program selects new varieties from among approximately 100,000 new entries each year for at least 24 characteristics, including, but not limited to, sucrose content, purity, early maturity, fiber content, cane tonnage, stubble longevity, harvestability, and resistance to selected disease and insect pests.

In 1995 and 1996, a total of 154,116 and 26,393 seedlings from the commercial (1994 and 1995 H Series) and basic breeding (1994 and 1995 HB Series) programs, respectively, were set to the field in spaced plantings, 18 in. apart, at the Ardoyne Farm. Additionally, 10,424 and 1,274 clones from the commercial (1993 and 1994 H Series) and basic breeding (1993 and 1994 HB Series) programs, respectively, were established in first-line trails. A total of 170 clones were assigned permanent Ho (Houma) or HoCP (Houma/Canal Point) numbers in 1995 and 1996 from the H 1990 and 1991 Series from the first-ratoon crop of the second-line trials. After selection, these clones were planted to a replicated nursery on both heavy and light textured soils at the Ardoyne Farm for further evaluation. Additionally, a total of 20 clones were assigned permanent US (United States) numbers in 1995 and 1996 from basic crosses made at Houma from the HB 1990 and 1991 Series. These 20 clones were returned to the basic breeding program as non-recurrent parents for another cycle of backcrossing in our continuing effort to broaden the genetic base and provide the industry with increased yield. **(B.L. Legendre, W.H. White, D.L. Verdun and C.K. Finger)**

Secondary Selection. The first stage of the breeding program in which plots are mechanically harvested is known as the infield stage (Stage V). This is also the first stage in which cultivars from the state breeding program (L's, LCP's, and LHo's) are tested with HoCP and Ho cultivars. Some varietal traits studied in the infield are sucrose and purity content, estimated yield of theoretical recoverable sugar per ton, stalk number, stalk weight, yield of tons cane per acre and estimated yield of sugar per acre, fiber percent cane, and harvestability.

Plots in infield tests are 16 ft long by 3 rows wide (18 ft). Each test is made up of two replications. For comparison, three commercial cultivars (CP 65-357, CP 70-321, and/or CP 74-383, CP 72-370, LCP 82-89) are included in each replication as controls. Plots are cut with a single-row, whole stalk harvester and then weighed with a tractor-mounted hydraulic weighing system. To be considered for further testing, experimental candidate cultivars must equal or exceed the control cultivars in yield of sugar per unit area, possess an acceptable level of disease and insect resistance, show adaptability to mechanical harvesting, and have good milling qualities (balance of fiber and juice extraction).

Experimental candidate cultivars from the 1991 through 1995 HoCP and Ho series and 1993 L series were harvested from infield tests in 1994. A brief discussion of each series follows.

1991 Series. Two candidate cultivars from the 1991 HoCP series (HoCP 91-552 and HoCP 91-555) were sampled from second-stubble and first-stubble tests at Ardoyne Farm in 1996. Both candidate cutivars were equal to the commercial cultivars in the yield of sugar per acre. However, HoCP 91-552 had a higher fiber percentage than CP 65-357 in first-stubble and has shown a higher percentage of fiber in previous tests.

1992 Series. Six experimental candidate cultivars from the 1992 HoCP series were harvested from second-stubble, first-stubble and plant-cane tests at Ardoyne Farm. All six cultivars in this series were equal to or higher than the commercial cutivars in sugar per acre. Four cultivars (HoCP 92-631, HoCP 92-648, HoCP 92-664, and HoCP 92-674) were higher than the commercial cultivars in sugar per ton in both the second-stubble and first-stubble tests..

1993 Series. Six HoCP cultivars from the 1993 series were harvested from first-stubble and plant-cane trials at Ardoyne Farm in 1996. Three experimental candidate cultivars from the L series were also harvested from the plant-cane test. HoCP 93-746 was higher than the commercial cultivars in yields of sugar per acre in both tests. The nine active candidate cultivars from this series were replanted in 1996. A plant-cane, first-stubble, and second-stubble test of the 1993 series will be harvested in 1997.

1994 Series. Twenty-one experimental candidate cultivars from the 1994 HoCP series were harvested from a plant-cane infield test in 1996. In this test, all but one experimental cultivar were equal to the commercial cultivars in sugar per acre. Two cultivars (HoCP 94-809 and HoCP 94-851) had more tonnage per acre than the commercial cultivars. These twenty-one candidate cultivars were replanted in 1996. **(E.O. Dufrene)**

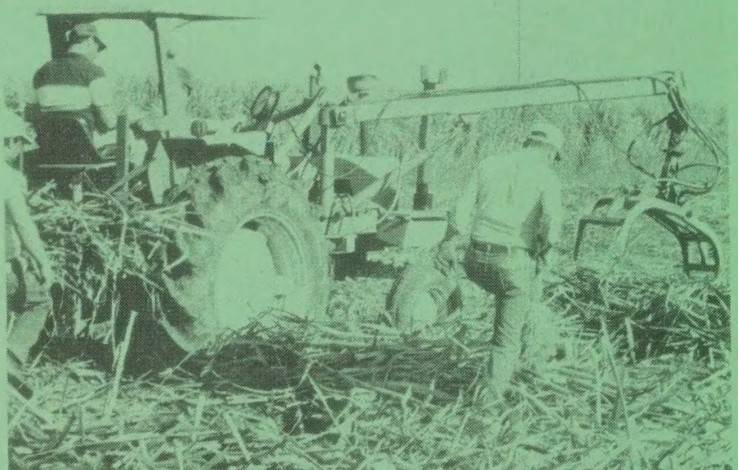
Outfield Selection. Outfield selection is the final stage in evaluating candidate cultivars for release to the Louisiana sugarcane industry. Outfield selection is a cooperative effort between USDA-ARS, Louisiana State University Agricultural Center, and the American Sugar Cane League. The work is conducted in cooperation with sugarcane growers at 10 locations throughout the sugarcane belt of Louisiana. Candidate cultivars are tested in replicated experiments [3 replications, with each plot 3 rows (18 ft) wide x 32 ft long] in the plant-cane, first-stubble, and second-stubble crops on both light and heavy soil. A minimum of seven commercial cultivars is included as controls in each outfield test.

In 1993, two new cultivars were released for commercial planting, LCP 85-384 and HoCP 85-845. Growers have accepted these two varieties due to high yields in sugar per acre especially LCP 85-384 (Table 1).

In 1996, HoCP 88-739 became a candidate variety for release. In sugar per acre, HoCP 88-739 was better than CP 70-321 in plant-cane, first-stubble, and second-stubble from 1993 through 1996. HoCP 88-739 is high in sugar per ton of cane and moderate in tons of cane per acre yields (Table 1). **(D.D. Garrison)**

Table 1. Average yield of sugar per acre in outfield tests in the plant-cane, first-stubble, and second-stubble crops on light and heavy soils during 1993-1996.

	Crop years		
	1993-1995	1994-1996	1995-1996
Cultivar	Plant-cane	First-stubble	Second-stubble
	%		
CP 72-321	6087	6404	5381
LCP 85-384	7261	8376	8038
HoCP 85-845	6833	7127	6699
HoCP 88-739	6724	7380	7408



Hydraulic weigh rig.

Recurrent Selection for Sugarcane Borer Resistance (RSB). Twelve sugarcane germplasm clone hybrids of *Saccharum spontaneum* L. and *S. officinarum* L., HoCP 92-678, Ho 73-775, Ho 93-776, US 93-15, US 93-16, US 93-17, US 96-1, US 96-2, US 96-3, US 96-4, US 96-5 and US 96-6 were developed by the USDA-ARS, Houma and Canal Point, FL and are scheduled for release in 1997 as resistant to the sugarcane borer (*Diatraea saccharalis* F.). These germplasm clones should

provide plant breeders with additional material expressing resistance to the sugarcane borer while maintaining acceptable yield and plant form.

Material for this release were derived from four RSB (recurrent selection for sugarcane borer resistance) breeding series: RSB 88, RSB 89, RSB 90 and RSB 91. They also represent the last release proposed from the S2 recurrent population. An earlier release of five selections from this cycle was made in 1993. Future releases are planned from the S3 cycle. Several S3 crosses have been made and progeny are planted in the field, but selections are still several years away from assignment. Germplasm clones considered for release are listed in the following table. These clones have been evaluated for several years and have repeatedly clustered in the most resistant group of each evaluation (Ward's Minimum Variance Cluster Analysis). They also yield comparable to commercial standards and have not expressed susceptibility to our major diseases. Seed for these clones are available upon request. **(W.H. White, J.D. Miller, D.M. Burner, and B.L. Legendre)**

Clones comprising the recurrent selection for borer resistance parental lines scheduled for release.

Selection	Parentage	Mean rating	Mean bored internodes	Cane yield[1]	TRS[1]	S/A[1]
			(%)	(%)	(%)	(%)
CP 92-678	HoCP 85-845 x CP 83-657	2.5	11.9	95	105	98
CP 93-775	HoCP 85-845 x CP 84-742	2.0	4.0	145	104	153
CP 93-776	CP 86-916 x CP 85-834	3.1	9.0	113	99	116
US 93-15	CP 85-861 x CP 85-384	2.2	4.5	90	70	63
US 93-16	LCP 84-222 x CP 85-834	2.1	9.1	113	79	90
US 93-17	HoCP 85-845 x CP 84-742	2.3	10.5	110	84	92
		3.0	8.0			
US 96-1	LCP 84-222 x CP 70-321	3.3[2]	15.5	93	87	84
		1.8	8.2			
US 96-2	LCP 85-298 x CP 85-834	3.4[2]	16.0[2]	178	49	88
		2.5	11.4			
US 96-3	CP 86-973 x LCP 82-89	4.0[2]	26.1[2]	93	90	86
		3.4	14.8			
US 96-4	CP 86-973 x LCP 82-89	3.4[2]	17.0[2]	107	86	98
US 96-5	CP 86-916 x LCP 84-222	3.0[2]	13.0[2]	92	90	82
US 96-6	CP 86-916 x LCP 84-222	2.4[2]	19.2[2]	92	76	73
CP 65-357		4.3	13.0			
Intermediate	CP 52-68 x CP 53-17	4.9[2]	32.8[2]			
CP 70-330		4.2	21.7			
Resistant	CP 61-39 x CP 57-614	5.3[2]	27.8[2]			
CP 72-355		4.0	29.1			
Susceptible	CP 52-68 x CP 62-258	4.7[2]	45.7[2]			

Continued.

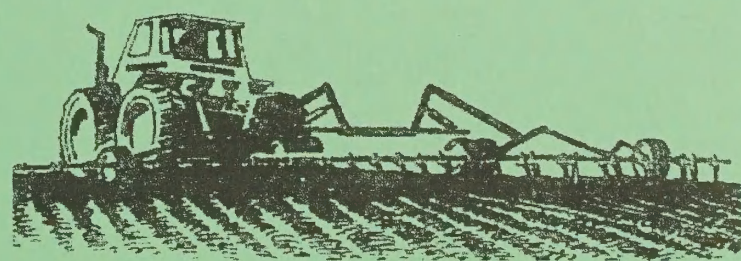
Table continued.

[1] Yield data were collected from second-line trail plots and are the average of both plant-cane and first-stubble crops. Percentages were calculated from the CP 70-321 plots planted in the same trail.

[2] Experiment WHW-PARENT-9605.

Adult moth of sugarcane borer (*Diatraea saccharalis*)

<u>Harvestability of Recently Released Louisiana Sugarcane Cultivars</u>. There has been a big shift in recent years in Louisiana from the soldier-type harvesting system to the combine harvesting system. Despite the system used, Louisiana's cane grower's would still benefit from cultivars that stand erect and produce high yields. Three of the most recently released cultivars (LCP 85-384, HoCP 85-845, and LCP 86-454), one experimental cultivar (HoCP 88-739), and six older cultivars (CP 65-357, CP 70-321, CP 72-370, CP 79-318, LCP 82-89, and LHo 83-153) were mechanically harvested with a single-row harvester in the plant-cane and first-stubble crops in 1995 and 1996 in a harvestability test at Ardoyne Farm, Schriever, LA. Data collected included percent of scrap after harvest, percent of stalks damaged by the harvester, and erectness rating at time of harvest. An analysis from the two crop years showed that HoCP 85-845 and LCP 86-454 were equal or better than the other commercial cultivars in the percent of scrap after harvest and erectness rating. LCP 85-384 had a significantly higher percent of scrap than all other varieties except CP 70-321. Even with this high percentage of scrap, LCP 85-384, along with HoCP 85-845 and LCP 86-454, were among the cultivars that produced the highest yields of sugar that made it to the heap row. **(E.O. Dufrene, D.D. Garrison, and B.L. Legendre)**



Harvestability and brittleness estimates of test H94 over two years.

Variety	Scrap	Machine broken	Erectness[1]
	(%)	(%)	(rating)
CP 65-357	6.0	16.3	6.67
CP 70-321	12.7	30.3	7.50
CP 72-370	7.4	23.7	6.50
CP 79-318	8.5	46.0	7.17
LCP 82-89	8.7	30.3	6.17
LHo 83-153	3.9	13.3	5.50
LCP 85-384	14.9	31.3	6.83
HoCP 85-845	2.3	33.3	5.50
LCP 86-454	3.0	14.7	5.17
HoCP 88-739[2]	4.5	26.0	5.83
LSD (0.05)	6.0	14.8	0.77

[1] The lower the number, the better the erectness.

[2] Candidate for release in 1997.

Inheritance Studies on Self-Stripping Character. In an effort to study the feasibility of selection for self-stripping in sugarcane which could reduce the need for burning, improve overall cane and juice quality, and better facilitate green-cane harvesting, a study involving 24 crosses with parental clones of self-stripping (SS) or tight clinging (TC) leaves and accompanying leaf sheaths was begun in the spring of 1993. Two hundred eighty-eight seedlings (clones) each of the 24 crosses representing SS x SS (Combination 1), SS x TC (Combination 2), TC x SS (Combination 3), and TC x TC (Combination 4) parental combinations were set to the field in a four replicate, randomized complete block design with 72 clones per replicate.

Little or no differences were noted in self-stripping behavior in the plant-cane crop of the single-stool stage, probably due to the immaturity of the crop (six months) at selection; however, there were significant differences noted in the first-stubble crop. Progeny of crosses with the best ratings for self-stripping occurred in the crosses between two self-stripping parents; whereas, progeny with the worst ratings occurred in the crosses between two tight clinging parents with the remaining progenies intermediate. A second assessment was made on November 2, 1994 where the first 40 clones of each plot were divided into three groups: 1) the number of clones with more than 50% leaves shedding (clean); 2) number with the majority of leaves loosely attached but still attached to stalk (loose); and 3) the number of clones with tight clinging leaves (clinging). The correlation coefficients between the ratings for self-stripping and number of clones with clean, loose, and clinging leaves and leaf sheaths were r = -0.858, -0.898, and 0.915, respectively, showing very good agreement. Further, the correlation coefficient between the ratings for self-stripping and the number of clones selected for the self-stripping character and replanted to 6-foot line (clonal) trials (n = 381) for the 24 crosses was r = -0.845, again showing close agreement. These data also showed a moderate association between ratings and agronomic type (r = 0.576) and between ratings and overall assessment of the progeny in each cross (r = 0.548) but no association between ratings and erectness of stalks (r = 0.050). Overall, the data suggest that selection for the self-stripping character is feasible and that the self-stripping type may be associated with overall agronomic type. **(B.L. Legendre)**

CYTOLOGY

While sexual reproduction in most grasses occurs through the production and union of haploid (n) gametes, studies of chromosome transmission in interspecific and intergeneric hybrids of sugarcane (*Saccharum*) have shown that exceptions to this rule are common. Some cross combinations in *Saccharum* yield $2n+n$ progeny, but it has not been conclusively determined whether elite clones produce $2n$ gametes. This information is useful in predicting hybrid performance.

Chromosome transmission was studied in 47 F_1, F_2, and BC_1 progeny derived in most cases from elite x exotic crosses. Hybrids of sugarcane x *Miscanthidium violaceum* or *Miscanthus sinensis* were from $n+2n$ chromosome transmission. Hybrids of sugarcane x *Miscanthus japonicus*, *S. robustum*, *S. spontaneum*, and F_2 and BC_1 progeny were from $n+n$ transmission. Hybrids from the exotic crosses *S. officinarum* x *S. robustum*, *S. officinarum* x *S. spontaneum*, *S. sinense* x *E. elephantinus*, and *S. spontaneum* x *S. officinarum* were derived from $n+n$ transmission. Chromosome pairing was regular in progeny of Louisiana Purple (*S. officinarum*, $2n$ = 80) x Molokai 5829 (*S. robustum* $2n$ = 80), but all other clones had univalents, trivalents, or quadrivalents. About 26% of microsporocytes in a hybrid from NCo 310 x *Miscanthidium violaceum* were multiploid, but it is unclear whether these form functional diploid or polyploid microspores. Thus, progeny analysis suggested that elite sugarcane clones produced only n megaspores. **(D.M. Burner)**

Metaphase I of CP 74-383 with 108 chromosomes.

PLANT PATHOLOGY

Sugarcane Mosaic. Cultivars of sugarcane differ in the amount of yield loss caused by infection with the sorghum mosaic virus (SrMV). Among the nine currently recommended cultivars, two are resistant to the SrMV, LHo 83-153 and LCP 85-384; one is moderately resistant, HoCP 85-845; and the others vary from susceptible to moderately susceptible. By incorporating resistance from wild sugarcane relatives and the identification and use of

resistant parents, mosaic resistance among the progeny of the most recent crosses has increased.

Samples of sugarcane plants showing mosaic symptoms were collected from across the sugarcane industry for over 20 years. Strains of the infecting virus were identified by inoculating differential host plants. Strain H of SrMV was predominant throughout the period. Strain I was the second most commonly recovered strain with the incidence the highest when the susceptible cultivar NCo 310 was a commonly grown cultivar. Strain M was recovered intermittently. **(M.P. Grisham)**

Sugarcane Smut. Candidate cultivars of sugarcane are screened for resistance to smut (*Ustilago scitaminea*) by dip inoculating seed cane in a 5 x 10^6 teliospores per ml suspension for 10 minutes prior to planting. The mean percent shoots infected is used to group the candidate cultivars into resistant, intermediate, and susceptible classes. The 1994 series of experimental cultivars had not been previously screened in an inoculated test. The high percentage of candidate cultivars in the resistant and intermediate classes among the 1990-1992 series reflects the elimination of highly susceptible candidate cultivars exposed to earlier natural inoculation and better parent selection for resistance to smut. **(B.L. Legendre & M.P. Grisham)**

Number and percent of CP, LCP, and L sugarcane candidate cultivars assigned to three smut resistance classes following the 1995-96 inoculated trial.

Series of cultivars	Resistance classes: Resistant No.	Resistant %	Intermediate No.	Intermediate %	Susceptible No.	Susceptible %
1990-92	16	80	4	20	0	0
1993	14	56	9	36	2	8
1994	25	59	7	17	10	24
Total	55	63	20	23	12	14

Ratoon Stunting Disease. The effect of ratoon stunting disease (RSD), caused by *Clavibacter xyli* subsp. *xyli*, was determined for the nine recommended cultivars. Yield of disease-infected plants was compared to the yield of uninfected plants. **(M.P. Grisham)**

Percent loss of yield (pounds sugar per acre) in sugarcane caused by ratoon stunting disease between 1993 and 1995.

Cultivar	Crop: Plant-cane	Crop: First-stubble	Crop: Second-stubble	Total crop cycle
CP 65-357	12	7	1	7
CP 70-321	17	27	2	15
CP 72-370	6	26	23	19
CP 79-318	(4)	12	(1)	3
LCP 82-89	9	4	10	8
LHo 83-153	26	29	25	26
LCP 85-384	8	16	7	10
HoCP 85-845	16	21	3	13
LCP 86-454	5	10	7	6

( ) = RSD-infected had higher yield than healthy.

RSD Diagnosis. The ratoon stunting disease bacterium, *Clavibacter xyli* subsp. *xyli (Cxx)*, was isolated from RSD diseased sugarcane tissue. Genomic DNA was extracted from pure *Cxx* bacteria. A 560 bp DNA product was amplified by polymerase chain reaction (PCR) with a pair of degenerate ribosomal DNA primers. This PCR product was proved to be *C. xyli*-specific and was used as a DNA hybridization probe to detect *Cxx* in infected sugarcane tissues in a tissue- or dot-blot format. **(Y.-B. Pan, M.P. Grisham, and D.M. Burner)**

Leaf Scald. Leaf scald caused by the bacterium, *Xanthomonas albilineans*, was first observed in November 1992. Surveys and observations have revealed that the greatest incidence in commercial fields has been among cultivars LCP 82-89 and HoCP 85-845. Inoculated tests also show these two to be the most susceptible among the nine recommended cultivars. Three cultivars, CP 79-318, LHo 83-153, and LCP 85-384, were rated resistant; while all others were intermediate to highly susceptible. Parents and advanced candidate cultivars are being screened for susceptibility to leaf scald in inoculated tests.

Tests have shown that the hot water treatment effective for the control of ratoon stunting disease does not control leaf scald; although soaking seedcane for 40 hours in ambient temperature water followed by a 3 hour treatment at 50° C will reduce the infection by the bacterium. Reinfection can occur by mechanical spread with the harvester or by aerial spread.

A polymerase chain reaction (PCR) protocol was developed that specifically detects *X. albilineans* in sugarcane tissue and sap. The PCR protocol is more sensitive than the serological dot-blot assay. The PCR protocol provides a rapid, reliable, and economical tool for routine diagnosis and certification of clean planting stock. **(M.P. Grisham, B.L. Legendre, D.M. Burner, and Y.-B. Pan)**

ENTOMOLOGY

In 1996 we released in Louisiana a new parasite of the sugarcane borer, ***Cotesia chilonis*** (Matsumura) (Hymenoptera: Braconidae). After several unsuccessful attempts by the Louisiana industry to establish ***Cotesia flavipes*** Cameron in Louisiana, we were encouraged by Dr. J.W. Smith Jr. (Texas A&M) to consider releasing ***C. chilonis***. This Braconid parasite was imported from Japan by Dr. Smith and had no been not been released in the U.S. Heretofore it had only been studied in the laboratory. Research indicated that Chilonis may be better adapted than Flavipes to the humid conditions of Louisiana and the sugarcane borer does not encapsulate Chilonis as readily as Flavipes. We followed the same rearing procedures for Flavipes to rear Chilonis and found the both insects equally adapted to laboratory colonizaton. Several releases were made early in the growing season (May and June) but we were unable to recover any parasitized larvae from these release sites. Extremely low populations of borer at the time of release may have contributed to the lack of success in establishing the parasite that first year. We will again attempt to establish the parasite in 1997 but only in those fields found supporting fairly high numbers of host. **(W.H. White and T.E. Reagan)**

JUICE, CANE, AND MILLING QUALITY

Juice and Milling Quality Laboratory. The purpose of the Juice and Milling Quality Laboratory located at the Ardoyne Farm, Houma, LA is to analyze sugarcane samples for either juice and/or cane quality using either 3-roller mill and/or core/press analysis obtained for commercial and candidate varieties from research plots. Further, the Laboratory is responsible for the testing of new and/or undated equipment used in sugarcane juice and cane quality. User scientists included: American Sugarcane League of the U.S.A., Inc. (ASCL), Thibodaux, LA; Louisiana Agricultural Experiment Station (LAES) and Louisiana Cooperative Extension Service (LCES), Baton Rouge, LA; Nicholls State University (NSU), Thibodaux, LA; Sugar Processing Research Institute, Inc. (SPRI), New Orleans, LA; Unites States Department of Agriculture, Agricultural Research Service (USDA-ARS), Baton Rouge and Houma, LA.

A total of 7,175 and 7,623 samples were analyzed in the Laboratory in 1995 and 1996, respectively. The traditional 3-roller mill was used for 77% of the samples while the core/press analysis was used for the remaining 23% of the samples. **(B.L. Legendre and C.K. Finger)**

Post-harvest Management of Billeted Cane for Optimal Cane and Juice Quality. Increasing environmental regulations may soon restrict or reduce the extent of field burning in Louisiana for the removal of leafy trash from sugarcane stalks prior to harvest. Further, there is evidence that field burning of whole-stalk cane may actually reduce sugar yield even though little or no deterioration products can be detected in the juice. Many growers are using cane combines to harvest newer varieties of sugarcane, especially LCP 85-384, which produce higher tonnages but are susceptible to lodging. The combine chops the cane stalks into billets of 7 to 14 in. (17.5 to 35.0 cm) and, with the aid of extractor fans, removes a significant portion of the leafy trash without burning. The number of cane combines operating in Louisiana has increased from 2 three years ago to more than 60 during the 1996-97 harvest. Although the combine can harvest green cane, many growers are burning standing cane prior to harvest to increase the efficiency of the harvester. Experience in other countries has shown that burned and/or chopped cane deteriorates faster than whole-stalk cane.

To evaluate post-harvest management of chopped cane in Louisiana for optimization of cane and juice quality, two field experiments comparing green vs. burned and whole vs. chopped cane of two varieties, CP 70-321 and LCP 85-384, were conducted during the 1996-1997 harvest season. Samples of green and burned, whole-stalk cane were harvested by hand in standing cane while samples of green and burned, chopped cane were taken directly form the elevator of the cane combine operating in the fields. Average billet length in both experiments was 10.1 inches (25.7 cm). Estimated yield of gross cane per acre averaged over 45 tons for both varieties.

Whole and chopped stalks of both green and burned cane were milled within 4 hours of harvest and at 1, 2 and 3 day intervals thereafter. Cane samples were analyzed for fiber content while juice samples were analyzed for Brix, pol, purity and dextran content. Samples for delayed milling were stored in the greenhouse at 80°F (26.6°C) and high humidity (60-100%).

It appeared that harvest management of chopped cane was the key to optimizing cane quality while post-harvest management was the key to juice quality. The dextran content of the juice of chopped cane, either green and burned, necessitates that cane harvested by combine be processed in a timely fashion, i.e., normally less than 24 hours. This was especially true for the variety LCP 85-384. No problems were noted in the juice of whole-stalk cane, either green or burned, when processed up to 3 days after harvest. **(B.L. Legendre and E.P. Richard, Jr.)**

Near Infrared (NIR) Routine Analysis of Sugarcane Juices. A near infrared NIR Systems Beverage Analyzer was utilized at the Juice Quality Laboratory, Ardoyne Farm, Houma, LA, during the 1995-1996 harvest season for the analyses of sugarcane juice samples of experimental clones from the sugarcane variety development program. The Beverage Analyzer instrument has two fixed probes so that no sample preparation was necessary. Results from 500 comparative tests for Brix and 350 tests for pol using the Beverage Analyzer and conventional methods compared favorably. The correlation coefficients for both parameters exceeded 0.97 and precision was good. This NIR method provides fast and accurate results without the use of any chemicals or clarification agents; therefore, it is an environmentally friendly method. **(M.A. Clarke, B.L. Legendre, L.A. Edye and C.V. Scott)**

Effect of Sugarcane Leaves and Mud on Color of Sugarcane Juice. During routine sediment tests conducted on cane juice samples from sugarcane stalks of the variety CP 70-321 containing varying amounts of leafy cane trash and field soil (mud) (0, 10, 20 and 30%, alone, and in combination), a wide range in color was noted in the supernatant which did not correlate with the sediment load of the juice. From these observations, a series of experiments were conducted to quantify the effect of leafy cane trash and mud on juice color. Results confirmed the deleterious effect of leafy cane trash, to include sugarcane leaf blades and sheaths but no tops, both desiccated and fresh, on juice color, with an approximate 6-fold increase in color over the range in leafy cane trash studied. The effect of leafy cane trash on color appeared nonlinear: color increased at a greater rate with each incremental increase in the level of cane leafy trash. On the other hand, mud (Mhoon silty clay loam with approximately 33% moisture) alone showed a decolorizing effect, due, undoubtedly, to the ion exchange properties of the soil type. Further, the effect of mud on color appeared linear: a decrease of 1.6% in color for each 1% increase in mud added to the cane sample. Leafy cane trash and mud in combination (equal amounts of both leafy cane trash and mud of up to a total of 30% total trash by weight of cane stalks) showed the opposing effects of the two components: color increased with and increase in total trash but not as much as with the leafy cane trash alone. The overall effect was nonlinear. In summary, it appears that in these preliminary studies, leafy cane trash added significant colorant to cane juice while heavy textured soil, i.e., silty clay loam, helped to decolorize cane juice. These results show that the components of trash can have different effects on cane juice color, and it is important to define the composition of the trash. Additional studies are planned with different varieties and/or different soil types to determine if this effect is independent of variety and/or soil type. Although mud appeared to reduce color, its harmful effects, such as, contributing to sugar losses in bagasse and filter cake, increased turbidity and ash, wear and tear to equipment, lowered fuel value of bagasse, etc. would still dictate

care in delivering clean, fresh cane to the factory for processing. **(B.L. Legendre, M.A. Godshall and X.A. Miranda)**

Fiber Content of Commercial and Candidate Varieties. Milling studies designed to measure the milling quality of commercial and candidate varieties are conducted on a continuing basis in the plant-cane and/or stubble (ratoon) crops of line (clonal) trials, nursery tests, and infield/outfield tests. Milling quality is defined in terms of an assigned Varietal Correction Factor (VCF) which is based primarily on the fiber content of the variety. When the yield of theoretical recoverable sugar per ton of cane (TRS/TC) is described for a new variety that yield is based not only on the Brix and sucrose content of the cane but also on its fiber content. Next to sucrose content, the level of fiber in cane is the next most important factor in calculating TRS/TC. Currently, it is the position of the breeding and selection program that the fiber content (on a net cane basis) of new varieties not exceed 14.0% because of the effect that fiber has on sugar yield at the mill. **(B.L. Legendre and C.K. Finger)**

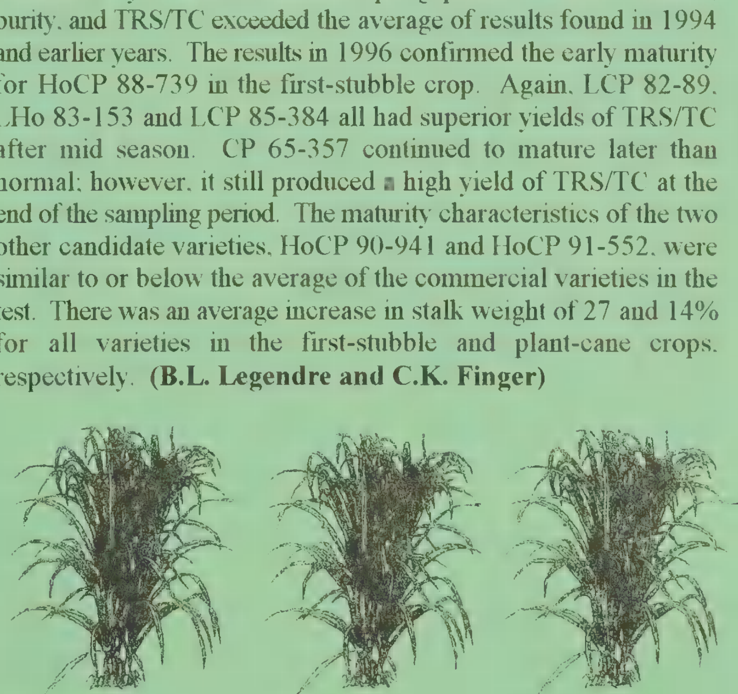
Fiber content of commercial and advanced candidate varieties.

Variety	Fiber content (%)	Variety	Fiber content (%)
CP 65-357	12.50	HoCP 90-923	12.08
CP 70-321	11.30	HoCP 90-941	12.02
CP 70-330	12.50	HoCP 91-527	13.68
CP 72-356	11.30	HoCP 91-552	15.11
CP 72-370	11.90	HoCP 91.555	13.54
CP 74-383	12.10	HoCP 92-618	13.85
CP 76-331	12.50	HoCP 92-624	13.46
CP 79-318	12.60	HoCP 92-631	14.95
LCP 82-89	12.71	HoCP 92-648	11.73
LHo 83-153	12.93	HoCP 92.664	14.38
LCP 85-384	12.50	HoCP 92-674	12.54
HoCP 85-845	13.05	HoCP 93-750	11.35
LCP 86-454	12.45	HoCP 93-754	11.70

Relative Maturity of Commercial and Candidate Varieties. Maturity studies designed to measure relative changes in juice quality and stalk weight of commercial and candidate varieties are conducted on a continuing basis at Houma in the first-stubble (ratoon) and plant-cane crops. Commercial and candidate varieties are planted on mixed land at the Ardoyne Farm each year in a randomized, complete block design with four (4) replications. Each plot is 3 rows by a minimum of 36 feet long. Plots are cultivated and fertilized according to recommended plantation practices; insecticides are applied as required. Beginning on or about September 15 in the first-stubble crop and October 1 in the plant-cane crop, a 15-stalk sample of each variety (five stalks from each of the three rows in the plot) is taken at biweekly intervals or monthly, respectively, until December 1 or 15, depending upon the date of the first freeze of the season. Each stalk is topped approximately four (4) inches below the terminal bud, stripped of all leafy trash, weighed, measured for length and milled once through a 3-roller mill. Juice samples are analyzed for Brix by refractometer and apparent sucrose by polarization. From these data the yield of theoretical recoverable sugar per ton of cane (TRS/TC) is calculated. Also, crusher juice analysis is converted to normal juice values using appropriate Brix and sucrose factors obtained form commercial factories prior to the installation of the core/press method of analysis -- 0.8854 for Brix and 0.8105 for sucrose. TRS/TC is converted to commercial recoverable sugar per ton of cane (CRS/TC) using a constant liquidation factor of 0.8345. Mean stalk weight is obtained from sample weight divided by the number of stalks. Mean stalk length is the average length for the 15-stalk sample from two of the four replications. Commercial varieties included in the maturity tests for both 1995 and 1996 in the first-stubble and plant-cane crops included CP 65-357, CP 70-321, CP 72-370, CP 79-318, LCP 82-89, LHo 83-153, LCP 85-384, HoCP 85-845, and LCP 86-454. Additionally, CP 74-383 was included in the 1995 test. In 1995, the candidate variety, HoCP 88-739, was sampled in the first-ratoon crop only and in 1996, it was sampled in first-stubble crop only. In 1996, two candidate varieties, HoCP 90-941 and HoCP 91-552, were sampled in the plant-cane crop only.

In 1995, the relative maturity of all varieties in both the first-stubble and plant-cane crops was below average when compared to prior years. Sucrose content, purity and TRS/TC were lower on the initial sampling dates, but the increase during the harvest season was greater when compared to the previous season. These results confirmed the early maturity of CP 72-370, HoCP 85-845, and LCP 86-454, and the high sugar yield (TRS/TC) of LCP 82-89, LHo 83-153 and LCP 85-384, especially after mid season. CP 65-357 matured much later in 1995 having very low sucrose content early in the season; however, sucrose content was near normal for the variety by the end of the sampling period. Except for HoCP 85-845 and LCP 86-454, the industry does not have a replacement for the early maturing variety CP 72-370. Further, it should be noted that although HoCP 85-845 is early to mature it does not have high sucrose content later in the season when compared to most of the remaining commercial varieties. The candidate variety, CP 88-739, has similar maturity characteristics of HoCP 85-845 and LCP 86-454 and could be of benefit to the industry in this respect early in the harvest season. There was an average increase in stalk weight of 17 and 10% for all varieties in the first-ratoon and plant-cane crops, respectively.

In 1996, the relative maturity of all varieties in both the first-stubble and plant-cane crops was again lower that normal; however, by the end of the sampling period, sucrose content, purity, and TRS/TC exceeded the average of results found in 1994 and earlier years. The results in 1996 confirmed the early maturity for HoCP 88-739 in the first-stubble crop. Again, LCP 82-89, LHo 83-153 and LCP 85-384 all had superior yields of TRS/TC after mid season. CP 65-357 continued to mature later than normal; however, it still produced a high yield of TRS/TC at the end of the sampling period. The maturity characteristics of the two other candidate varieties, HoCP 90-941 and HoCP 91-552, were similar to or below the average of the commercial varieties in the test. There was an average increase in stalk weight of 27 and 14% for all varieties in the first-stubble and plant-cane crops, respectively. **(B.L. Legendre and C.K. Finger)**



Natural maturity in the plant-cane and first-stubble crops as measured by the yield of theoretical recoverable sugar per ton of trash-free cane (TRS/TC) as an average of three varieties. CP 65-357, CP 70-321 and CP 72-370.

	TRS/TC (lb)			
	Plant-cane crop		First-stubble crop	
Year	Oct. 1	Dec. 1	Sept. 15	Dec. 15
1992	176	275	156	295
1993	182	240	182	282
1994	183	256	188	292
1995	199	256	168	284
1996	181	274	155	294

Stalk Cold Tolerance of Commercial and Candidate Varieties. The exposure of sugarcane to damaging frosts occurs in over 20 of the 79 sugarcane producing countries, but is most frequent on the mainland of the United States. The frequent winter freezes in the sugarcane area of Louisiana forced the industry to adapt to a short growing season (7-9 months) and a short milling season (about 3 months). Variety trials for estimating stalk cold tolerance by measuring post-freeze deterioration of stalks of commercial and advanced candidate varieties in the field are routinely planted at the Ardoyne Farm, Houma, LA and at Bunkie, LA. Commercial varieties of known cold tolerance are grown as controls. They include, but are not limited to, the following varieties: CP 70-321 and NCo 310 for good cold tolerance and CP 79-318 and L 65-69 for poor cold tolerance. The cane is allowed to remain in the field until the first freeze of the harvest season of the year following planting (plant-cane crop). Just prior to and following a freeze, 15-stalk samples are removed serially along the center row of a three row plot. Normally, from 1 to 5 post-freeze samples are taken depending upon the severity of the freeze and post-freeze weather conditions. Each sample is cut at the ground by hand but not topped, weighed and past once through a 3-roller mill. Juice samples are analyzed for Brix by refractometer, apparent sucrose by polarization, pH, titratable acidity, and dextran by the ASI II Method. From these data the purity and the yield of theoretical recoverable sugar per ton of cane (TRS/TC) is calculated. When possible, visual ratings are made for both leaf and stalk cold tolerance in the field.

The results for the 1995 and 1996 seasons suggest the following classification of the recommended commercial varieties based on post-freeze resistance to deterioration of juice in stalks using the parameters mentioned above.

RESISTANT	INTERMEDIATE	SUSCEPTIBLE
CP 70-321	CP 65-357	CP 72-370
LHo 83-153	LCP 85-384	CP 79-318
HoCP 85-845	LCP 86-454	LCP 82-89

Based upon the results obtained in the 1995 and 1996 tests, the candidate variety, HoCP 91-552, would receive a classification of SUSCEPTIBLE. **(B.L. Legendre and C.K. Finger)**

WEED CONTROL AND CULTURAL PRACTICES[a]

Cultivar Tolerance to Asulam and Terbacil. Recently-released Louisiana sugarcane cultivars LCP 82-89, LHo 83-153, HoCP 85-845, LCP 85-384, and LCP 86-454 were compared with older cultivars CP 72-370 and CP 74-383 or CP 70-321 for tolerance to asulam (ASULOX) postemergence (June application) and nondirected soil treatments of terbacil (SINBAR), either when applied only in the plant-cane crop or in both the plant-cane and following stubble crops. The relative tolerance to certain herbicides becomes an important characteristic of a cultivar. The magnitude of the response of individual cultivars to asulam and terbacil, as measured by cane and sugar yield, varied among experiments, but none of the newer cultivars were consistently less tolerant than CP 72-370, which is known to be relatively sensitive to both herbicides. Asulam caused some reduction in cane yield of both newer and older cultivars, usually in the range of 5% to 10%, which probably was influenced by the June application since earlier spring applications are known to be generally less phytotoxic. Terbacil also reduced cane yields, usually in the range of 5% to 12%, but much larger reductions occurred occasionally in plant-cane experiments on silty loam soils having relatively low organic matter (1.3% to 1.6%) and/or clay (10% to 14%), thus low adsorptive capacity. However, the newer cultivar LHo 83-153 had relatively good tolerance to terbacil on the same type of soil, being much more tolerant than older cultivar CP 70-321, and generally appeared to be one of the most herbicide-tolerant cultivars. The study indicated that careful management will be needed when using asulam and terbacil on most of the newer cultivars, similar to practices now being used with CP 72-370. These practices include applying asulam early in the growing season (April or early May) to minimize the risk of injury, and avoiding or minimizing use of terbacil on very coarse-textured soils low in organic matter, particularly in the plant-cane crop. **(R.W. Millhollon)**

Seedling Johnsongrass Control. Studies have been conducted to evaluate the use of several experimental herbicides for the control of seedling johnsongrass when applied at planting and again in March of the plant-cane growing season. At planting and March applications of clomazone at 1.0 and 2.0 lb ai/A and thiazopyr at 0.25 and 0.38 lb ai/A applied in mixture with atrazine at 2.0 lb ai/A were compared to standard at planting followed by spring applications of atrazine, metribuzin, and terbacil. Also included were applications of sulfometuron at 0.025 and 0.05 lb ai/A applied in mixture with atrazine at planting followed by metribuzin in the spring at 1.8 lb/A and mixtures of metribuzin and terbacil with atrazine. The highest levels of seedling johnsongrass control (>90%) were observed where clomazone at 1.0 and 2.0 lb/A was applied and where metribuzin and terbacil were applied in mixture with atrazine. Spring applications of clomazone caused the characteristic bleaching of the sugarcane leaves that came in contact with the spray droplets. However, sugarcane quickly recovered from the injury. Johnsongrass panicle numbers were reduced by at least 62% where standard rates of metribuzin and terbacil were applied alone. Inclusion of atrazine in the mixture did not result in a further decrease in panicle numbers. Both clomazone and sulfometuron controlled johnsongrass, based on late-season johnsongrass panicle counts, as well as metribuzin and terbacil. Thiazopyr at the rates evaluated, controlled johnsongrass but to a lesser extent than the standards. Of the treatments evaluated, control of yellow and purple nutsedge was highest where metribuzin and terbacil were applied. **(E.P. Richard, Jr.)**

Rhizome Johnsongrass Control with Asulam. Studies were conducted over two years to develop economic data for postemergence application(s) of asulam in sugarcane to control johnsongrass. Asulam was applied as a single application in mid April, early May, and early June and as a sequential mid-April followed by early June treatment. When asulam was applied once, a tank mixture of pendimethalin plus atrazine was applied 2 to 3 weeks earlier to control seedling johnsongrass and other seedling weeds. When asulam was applied twice, only atrazine was applied earlier to control broadleaf weeds. Johnsongrass control 4 weeks after treatment with asulam ranged from 61 to 87% with control generally being lowest where asulam was applied as a single treatment in June. Total leaf trash (cane and johnsongrass) on the heap after harvest was similar for the various treatments because more sugarcane stalks were produced when johnsongrass was controlled. The highest amount of johnsongrass biomass was obtained in harvested plots receiving one application of asulam either in April or June and the lowest amount of johnsongrass residue was obtained where asulam was applied twice. For the April application, the johnsongrass residue represented regrowth from the early treatment; for the June application, the biomass represented poor control of the treated plants. Because total leaf trash was similar, TRS levels for the various treatments were similar and sugar yields reflected differences in gross cane yields. Averaged over locations, all asulam treatments increased sugar yields when compared to the weedy check. Single applications of asulam in April (34%) and May (32%) increased sugar yields more than a June (17%) application. Two applications of asulam did not increase sugar yields over the April application but did over the May and June applications. In a separate study, sugar recovery was negatively impacted more when johnsongrass was the source of fiber than when sugarcane leaves were the source of fiber. These results suggest that when fiber source is considered, two applications of asulam would be more effective than a single April application, particularly if burning is not an option when the field is harvested and stands are adequate to produce an additional stubble crop. The extra cost of the second application of asulam could be partially offset by eliminating the March application of a preemergence herbicide to control seedling johnsongrass. **(E.P. Richard, Jr.)**

Biological Weed Control. Methods have been developed to infect johnsongrass with the fungus *Sphacelotheca holci* which causes loose kernel smut, a disease of johnsongrass manifested by smutted seed heads. However, ongoing studies show that this disease has both potential and limitations as a biocontrol. On the positive side, the disease is systemic and prevents seed formation in infected seed heads. On the negative side, it is slow to cause infection and the overall growth of johnsongrass is not greatly affected since the fungus is an obligate parasite and does not kill the host. Current research is designed to investigate combinations of this disease and herbicides for johnsongrass control. In other research, fungal plant pathogens are being evaluated for possible biological control of annual morningglory and bermudagrass. **(R.W. Millhollon)**

Itchgrass Control. The first flush of itchgrass germination in sugarcane fields usually occurs in early spring before herbicides are applied. Consequently, herbicide treatments should have both preemergence and postemergence properties. Pendimethalin presently is the most effective registered herbicide for nonincoporated preemergence control of itchgrass, but it does not provide effective postemergence control. Studies showed that itchgrass 2 inches or less tall can be controlled with a mixture of pendimethalin at 3.0 lb/A, atrazine at about 2.4 lb/A, and a 0.5% (v/v) nonionic surfactant. Adding 2,4-D at 2.4 lb/A to this mixture can increase the level of control. For larger itchgrass , averaging about 4 to 5 inches tall, a mixture of pendimethalin with either diuron at 2.0 lb/A or ametryn at 2.4 lb/A and a 0.5% surfactant will provide good control. For itchgrass averaging about 6 to 7 inches tall, a mixture of pendimethalin and asulam at 3.34 lb/A with a 0.5% surfactant is required. Diruon or ametryn in the mixture with pendimethalin can cause significant injury to cane, with the injury generally increasing as temperatures rise in the spring. Thus, these herbicides should primarily be used in early spring and should be used in directed sprays whenever possible. Experimental herbicides that have shown promise for itchgrass control include a mixture of clomazone (Command) and sulfentrazone (Authority) for pre- and early postemergence control and thiazopyr (Visor) for preemergence control. **(R.W. Millhollon)**

Bermudagrass Control in Sugarcane. Earlier studies suggest that bermudagrass must be removed in February or March to minimize yield losses of 15% or more. Because bermudagrass is usually dormant at this time, it would be somewhat less susceptible to postemergence herbicide treatments if they were available. Studies have been concentrated on developing fallow/plant-cane systems to control bermudagrass. In these systems bermudagrass is subjected to tillage and applications of glyphosate in the fallow before planting the crop. Several herbicides have been evaluated for the control of bermudagrass on the row top after the crop is planted. Controlling bermudagrass growing in the water furrow with glyphosate has also been included in these systems. Of the herbicides applied to a 36-in. band on the row top after planting and again in the spring, bermudagrass development is slowed to a greater extent when either clomazone, metribuzin, terbacil, or trifluralin (incorporated) was applied. Control with pendimethalin is somewhat lower and equivalent to applications of atrazine applied alone. At-planting applications of imazapyr and sulfometuron followed by metribuzin in the spring were also effective in reducing the amount of bermudagrass on the row top in the plant-cane crop. When glyphosate is applied to the wheel furrow at a broadcast rate of 2 lb ai/A, bermudagrass infestations on the row top were reduced by approximately 50% in the fall after planting. Bermudagrass infestation levels increased in the plant-cane and first-stubble crops regardless of the herbicide applied to the row top, but it increased at a faster pace when glyphosate was not included as an after planting treatment. Where metribuzin was applied at planting and in the following springs of the plant-cane and first-stubble crops and glyphosate was applied to the water furrow in the fall after planting, sugar yields were increased in the first-stubble crop by 560 lb/A. Bermudagrass response to spring applications of glyphosate in a shielded sprayer after bermudagrass greenup but before off-barring was minimal and crop yields were generally not increased. After harvest treatments in cane cut for seed have been investigated over several years. Treatments included banded and broadcast applications of atrazine or terbacil to undisturbed rows and rows that were shaved and the sides cultivated and applications of glyphosate to the water furrows. A trifluralin treatment was included. Incorporation was accomplished by throwing soil from the row sides on top of the treated row while cultivating. Bermudagrass cover on the row top averaged 76% where atrazine was applied and 63% where terbacil was applied regardless of application width. An application of

glyphosate at 3 or 4 lb/A controlled 90+% of the bermudagrass growing in the wheel furrow but improved control on the row top only slightly. Cultivation of the row sides had little effect on bermudagrass infestation but shaving the row top reduced bermudagrass infestation by approximately 10%. Where trifluralin was applied to the shaved row top, bermudagrass infestation was 26% to 34% lower than where terbacil was applied to a 36-in band. Despite differences in bermudagrass control in the fall, bermudagrass infestation levels the following spring were similar for all treatments (75 to 90% of row top covered) except where trifluralin was applied (47 to 54% covered). Shaving, even when done in the fall appeared to be injurious to the crop. Hence, yield increases associated with trifluralin's control of bermudagrass were not observed, and in fact, yields were actually lower than where row tops were not shaved and bermudagrass infestations exceeded 90%. **(E.P. Richard, Jr.)**

Bermudagrass and Johnsongrass Control in Succession-Planted Sugarcane. At-planting followed by spring applications of sulfometuron were compared to similar applications of metribuzin and terbacil. When sulfometuron was applied at 0.025 to 0.05 lb/A at planting and 0.02 lb/A in the spring of the following year, bermudagrass infestation levels were reduced when compared to the standard treatments. Increase levels of bermudagrass control did not translate into higher plant-cane yields. When sugarcane was succession-planted into fields heavily infested with rhizome johnsongrass, johnsongrass infestation levels were reduced 37% when metribuzin was applied at 1.8 lb/A and 79 to 93% when sulfometuron was applied at 0.05 to 0.14 lb/A. A postemergence application of asulam was made in April where metribuzin was applied and May where sulfometuron was applied due to the early control afforded by sulfometuron. Because of the johnsongrass control afforded by the timely asulam application, sugar yield with the at-planting followed by spring applications of metribuzin was similar to the sulfometuron at planting followed by sulfometuron in the spring treatment in one year but in a second year, sugar yields were 8% higher when sulfometuron was applied. Results suggest that where fields heavily infested with either bermudagrass or johnsongrass are succession planted, at-planting applications of sulfometuron, if registered, could be used to minimize the impact of the weeds on crop development. **(E.P. Richard, Jr.)**

Effects of Combine-Generated Trash Blankets on Weed and Sugarcane Development. Studies were conducted during the 1994 and 1995 growing seasons on second stubble CP 70-321. On average, the green cane trash blanket (GCTB) produced 6,160 lbs of dry biomass per acre which formed a uniform 4-in. cover over the harvested area. In the spring, cool season weed infestations were 62 and 71% lower where the GCTB was not removed after harvest. Morningglory was the predominant warm-season weed species in May just prior to the layby cultivation. There were 79% fewer morningglory plants in plots whose GCTB was not removed in the fall after harvest. In addition, to suppressing weed development, the GCTB slowed the emergence of the sugarcane. In March, sugarcane shoot numbers were 29% lower where the GCTB was not removed from the row top. By August, there was still 5% fewer stalks where the GCTB was not removed. As an average of the two locations, cane and sugar yields of second-stubble CP 70-321 sugarcane were reduced 5 and 6%, respectively, where the GCTB was not removed from the row top. In the warm, dry climates of the tropical countries that produce sugarcane, it is not uncommon to see a reduction in the emergence and growth of sugarcane when the GCTB is not removed. Over the course of their longer growing seasons, the crops grown in these areas are able to catch up. In Louisiana, it also appears that sugarcane emergence in the spring is suppressed by sugarcane residues which blanket the field after harvest. Louisiana has a temperate climate and a shorter growing season, especially for the stubble crops. Hence, stubble crops may not be able to recover from early suppression. Weed emergence was slowed in the presence of the trash blanket. However, herbicide treatments applied in the spring and after layby controlled these weeds sufficiently to limit their impact on the crop. **(E.P. Richard, Jr.)**

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[a]Common and trade names of herbicides mentioned in this report: asulam = ASULOX/ASULAM; atrazine = AATREX; clomazone = COMMAND; glyphosate = ROUNDUP; imazapyr = ARSENAL; metribuzin = SENCOR/LEXONE; pendimethalin = PROWL; sulfometuron = OUST; terbacil = SINBAR; thiazopyr = VISOR; trifluralin = TREFLAN (GENERICS)

GROWTH REGULATORS

Chemical Ripeners. Glyphosate (POLADO L) is labled for use only in stubble crops in Louisiana, Florida, and Texas because of possible phytotoxicity if used in the plant-cane crop. Recent studies determined the effect of annual glyphosate applications on several sugarcane cultivars during a standard 3-yr crop cycle in Louisiana, beginning in the plant-cane crop and continuing into the first- and second-stubble crops. Annual applications of glyphosate at 0.3 lb/A and a treatment-harvest interval (THI) of 27 to 42 days consistently increased the sucrose concentration of juice, purity (ratio of apparent sucrose to Brix), and theoretical recoverable sugar per kg cane (TRS) in the plant-cane and stubble crops of cultivars, as compared to untreated controls. However, whereas mean annual TRS was increased 14% at a THI of 42 and 30 days, respectively, mean annual sugar yield, the product of TRS and cane yield, was increased only 6% and 7%, respectively, because of the generally adverse effect of treatments on cane yield. Glyphosate treatments decreased cane yield by slowing cane growth immediately after treatment, thus reducing stalk weight, and by occasionally retarding or reducing regrowth (stubbleing) of some cultivars in the following crop (first-stubble crop in one experiment and second-stubble crop in another). This study indicates that annual glyphosate ripener treatments will usually increase mean annual sugar yield, but the magnitude of the increase will largely depend on cultivar tolerance to the annual treatments. Cultivar CP 70-321 appeared to have adequate tolerance to annual treatments whereas CP 65-357 was too sensitive **(R.W. Millhollon and B.L. Legendre)**

Response of Commercial Varieties to the Chemical Ripener Glyphosate. The varietal response of sugarcane to the chemical ripener glyphosate was evaluated at the Ardoyne Farm, Houma, LA in the second-stubble (ratoon) crop of 10 varieties in 1995 and 9 varieties in 1996. The experimental design was a 2 X 10 or 9 full factorial consisting of two (2) glyphosate treatments [0.3 lb/ac (0.23 lb a.e./ac) and untreated check serving as control and the varieties arranged in a randomized complete block design with two

(2) replications in 1995 and four (4) replications in 1996. Each plot consisted of a single row of cane by 36 feet long with a buffer row of the same variety separating adjacent plots in adjoining rows. Glyphosate was applied on Sept. 15 in 1995 and Sept. 26 in 1996. Varieties common to both tests included CP 65-357, CP 70-321, CP 72-370, CP 79-318, LCP 82-89, LHo 83-153, LCP 85-384, HoCP 85-845 and LCP 86-454. CP 74-383 was included in the 1995 test only. Glyphosate was applied uniformly over the top of the sugarcane plant canopy in a water solution at 20 gal/ac using a CO_2 pressurized sprayer and an hand-held boom. NALCO-TROL (0.03% v/v) for drift-control was added to all spray solutions. No rainfall was collected the day of application. All results were compared with those from untreated (control) plots.

Fifteen consecutive stalks were sampled from each plot at 3, 4, 5 and 6 weeks after treatment (WAT). All stalks were hand cut, stripped of leaves, topped at the apical meristem (bud), weighed and passed once through a prebreaker that prepared the sample for processing and analysis. A subsample of 2.2 lb of the prepared cane was pressed in a hydraulic press at 2,500 psi for 2 minutes, 15 seconds: this procedure separates the cane sample into juice and residue (bagasse), both of which are analyzed, the former for Brix by refractometer and sucrose by polarimetry and the latter only for moisture (by drying). The Brix, sucrose and fiber % cane are calculated from these analyses. From these data, the estimated yield of theoretical recoverable sugar per ton of cane (TRS/TC) was calculated according to the method described by Legendre (1992). Mean stalk weight was calculated by dividing sample weight by the number of stalks per sample.

To determine the possible effect of glyphosate on the stand of the subsequent stubble crop, population counts were made in the third-stubble crop of the 1995 test on a monthly basis in 1996 beginning in March and ending in August. The August counts were considered as the number of millable stalks to be found at harvest.

In 1995, glyphosate had no effect on mean stalk weight; however, it did reduce fiber content for all varieties. There was no significant increase noted in TRS/TC for any individual variety at 3 WAT although there was a significant increase as an average of all varieties. Significant increases occurred for all varieties at either 4, 5 and/or 6 WAT and as an average of all varieties at each sampling date.

In 1996, glyphosate again had no effect on the mean stalk weight of individual varieties; however, when averaged over varieties, there was a significant reduction on each date of harvest. No differences were noted in fiber between treated and control plots. There was an increase in TRS/TC for glyphosate treated cane at 3 WAT for four (4) varieties, CP 72-370, LHo 83-153, LCP 85-384 and LCP 86-454, as well as as an average of all varieties. Again, there was a significant increase for all varieties at either 4, 5 and/or 6 WAT and as an average of all varieties at each sampling date.

Initial stand counts taken on Mar. 5, 1996 showed that the number of shoots in treated plots was actually numerically higher for all varieties with the exception of LHo 83-153. Counts taken Aug. 5 indicated that glyphosate increased the millable stalks for two (2) varieties, CP 72-370 and HoCP 85-845. For all other varieties, the millable stalk counts were numerically higher in control plots with the exception of LHo 83-153. **(B.L. Legendre and C.K. Finger)**

1995 Climatic Conditions

Sugarcane Field Laboratory, Houma, Louisiana

Month	Temperature, °F Mean	Temperature, °F Depart.	Rainfall, in. Total	Rainfall, in. Depart.	No. rainy days Total	No. rainy days Depart.
Jan.	52.5	- 2.4	3.51	- 0.77	10	+ 2
Feb.	56.5	- 0.4	7.41	+ 3.12	10	+ 2
Mar.	63.8	+ 1.3	9.22	+ 4.79	10	+ 2
Apr.	69.1	+ 0.5	1.22	- 3.00	6	0
May	77.9	+ 3.2	4.26	- 0.24	11	+ 4
June	80.0	+ 0.1	4.66	- 1.41	9	- 1
July	83.2	+ 2.0	10.82	+ 2.73	20	+ 5
Aug.	84.2	+ 1.8	4.54	- 2.71	10	- 4
Sept.	80.0	+ 1.6	0.73	- 5.97	4	- 6
Oct.	70.0	+ 0.2	2.14	- 1.61	7	+ 2
Nov.	61.3	+ 0.2	5.36	+ 1.53	8	+ 2
Dec.	54.8	- 0.2	3.64	- 1.28	11	+ 3
Total/ Mean	69.4	+ 7.9	57.51	- 4.82	116	+110

1996 Climatic Conditions

Sugarcane Field Laboratory, Houma, Louisiana

Month	Temperature, °F Mean	Temperature, °F Depart.	Rainfall, in. Total	Rainfall, in. Depart.	No. rainy days Total	No. rainy days Depart.
Jan.	51.8	- 3.1	2.50	- 1.78	10	+ 2
Feb.	56.1	- 0.8	2.46	- 1.83	2	- 6
Mar.	57.6	- 4.9	1.84	- 2.59	7	- 1
Apr.	63.6	- 5.0	2.21	- 2.01	6	0
May	78.0	+ 3.3	0.78	- 3.72	4	- 3
June	80.6	+ 0.6	9.99	+ 3.92	15	+ 5
July	83.0	+ 1.8	11.54	+ 3.45	19	+ 4
Aug.	81.3	- 1.1	5.29	- 1.96	17	+ 3
Sept.	79.3	+ 0.9	5.31	- 1.39	14	+ 4
Oct.	69.6	- 0.2	1.51	- 2.24	7	+ 2
Nov.	63.2	+ 2.1	1.29	- 2.51	6	0
Dec.	58.0	+ 3.0	4.76	- 0.16	11	+ 3
Total/ Mean	68.5	- 3.3	49.48	-12.85	118	+13

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